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APPENDIX 30
SYSTEM CONTROLLER - SORTER INTERFACE
FINAL SOFTWARE REPORT
DATA ITEM NO. A005

**INTEGRATED ELECTRONIC WARFARE SYSTEM
ADVANCED DEVELOPMENT MODEL (ADM)**

780098730

PREPARED FOR
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PENNSYLVANIA
CONTRACT N62269-75-C-0070

RAYTHEON

ELECTROMAGNETIC
SYSTEMS DIVISION

APPENDIX 30
SYSTEM CONTROLLER/SIGNAL SORTER INTERFACE
FINAL SOFTWARE REPORT
DATA ITEM A005

INTEGRATED ELECTRONIC WARFARE SYSTEM (IEWS)
ADVANCED DEVELOPMENT MODEL (ADM)

Contract No. N62269-75-C-0070

Prepared for:

Naval Air Development Center
Warminster, Pennsylvania

Prepared by:

RAYTHEON COMPANY
Electromagnetic Systems Division
6380 Hollister Avenue
Goleta, California 93017

1 OCTOBER 1977

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CODE IDENT NO.

SPEC NO.
53959-JK-1002

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REV 3

TYPE OF SPEC

INTERFACE CONTROL DOCUMENT

TITLE OF SPEC

SYSTEM CONTROLLER - SORTER ICD

FUNCTION	APPROVED	DATE	FUNCTION	APPROVED	DATE
WRITER	J. Kolanek	7/25/75			

REVISIONS

CHK	DESCRIPTION	REV	CHK	DESCRIPTION	REV
	Complete Revision 1/2/76	1			
2	Complete Revision 7/30/76	2			
3	See Below	8/5/76	3		

Para. 3.1.2.3C

Was: (to Sorter)
Is: (from Sorter)

Para. 3.1.4.2.4

Change addresses from octal representation to hexadecimal.

Table I

Change addresses from binary representation to hexadecimal.

Figure 6

Add pin numbers.

SYSTEM CONTROLLER - SORTER
INTERFACE CONTROL DOCUMENT

1.0 SCOPE

This document shall describe the Classification Processor (CP) Bus which provides an interface between the Sorter and the System Controller. The functional as well as the detailed physical requirements shall be included in this document.

2.0 APPLICABLE DOCUMENTS

The following documents, of the latest issue in effect, form a part of this specification to the extent specified herein. In the event of conflict, the requirements of this specification shall govern.

53959-GT-0301	System Controller, ADM, IEWS, Unit Hardware Development Specification.
ESD-SB-001	Signal Sorter, IEWS, Equipment Design and Performance Specification.
CG-893645	IEWS Signal Sorter, Computer Program Performance Specification.

3.0 REQUIREMENTS

3.1 INTERFACE DEFINITION

3.1.1 General

An interface, referred to as the Classification Processor bus, shall be established between the System Controller and the Sorter for the purpose of transferring commands and data between the two units. In addition, provisions shall be made to allow the Special Test Equipment to be connected to this interface for the purpose of monitoring message traffic.

This interface shall be organized as shown in Figure 1, with the three units (the Sorter, System Controller and the Special Test Equipment) interconnected

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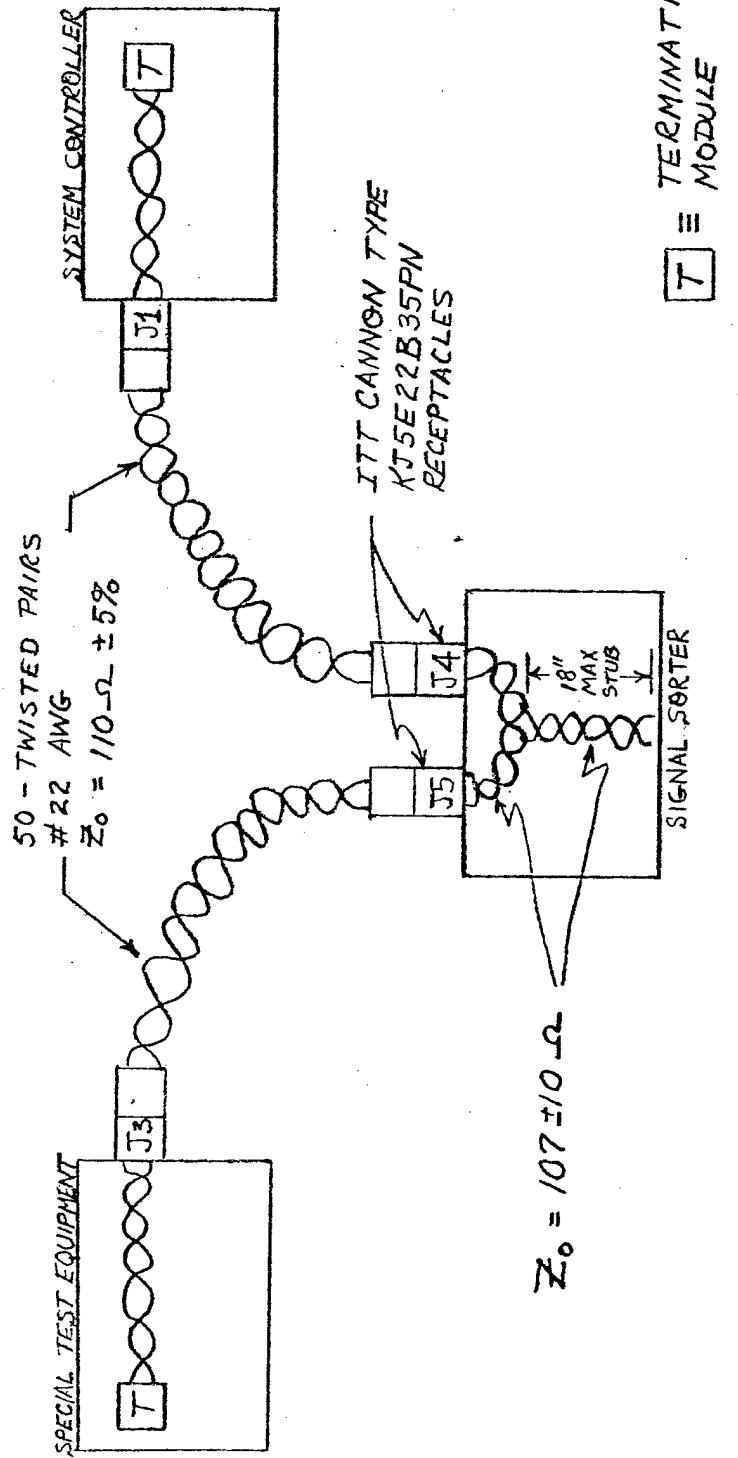


FIGURE 1. SYSTEM CONTROLLER-SIGNAL SORTER INTERFACE

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using an asynchronous bus structure. Bus control shall reside within the System Controller.

3.1.2 Bus Structure

The Classification Processor bus shall consist of a RP-16 micro-processor bus structure. This bus shall consist of four sets of lines: address, data, control and interrupt.

3.1.2.1 **Address Lines.** There shall be sixteen address lines used to identify memory locations within the Sorter which are used to store or retrieve data involved in the information transfer.

3.1.2.2 **Data Lines.** There shall be sixteen data lines used to transfer data involved in the information transfer.

3.1.2.3 **Control Lines.** There shall be six control lines used to effect data transfers. These shall consist of the following

- a. read/write (to Sorter)
- b. request (to Sorter)
- c. skip (from Sorter)
- d. acknowledge (from Sorter)
- e. master clear (to Sorter)
- f. power fail (from Sorter)

3.1.2.4 **Interrupts.** There shall be a single interrupt line used to signal the System Controller that a high priority message transfer is required from the Sorter.

3.1.3 Bus Control

Bus control shall reside in the System Controller. Messages shall be considered to be transferred into the Sorter from the System Controller as a

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write operation while messages shall be considered to be transferred from the Sorter to the System Controller as a read operation. The Special Test Equipment shall be a listen-only device capable of monitoring and/or recording all bus messages.

3.1.4 Data Transfer Conventions

Data shall be transferred using one of three approaches:

- a. direct memory addressing
- b. message block transfer
- c. address control

3.1.4.1 Direct Memory Addressing. Direct memory addressing shall consist of directly addressing the memory location involved in the data transfer and employing a read or write operation to effect the data transfer. It is intended that this mode of operation be used primarily for Sorter program load operations.

3.1.4.2 Message Block Transfers. Normal operational command and data transfers shall be made using a message block transfer technique. A message block shall consist of sixteen word units as shown in Figure 2. The block shall be headed by a status word and a command word followed by up to fourteen additional data words. All message blocks shall be transferred using designated message buffer areas within the Sorter and four such areas shall be established.

- a. Sorter input low priority buffer
- b. Sorter output low priority buffer
- c. Sorter output high priority buffer
- d. Sorter input high priority buffer

3.1.4.2.1 Status Word. The status word shall consist of two fields, a valid bit and a length field. The valid bit shall be used to indicate valid data is contained within the buffer area. The word length field shall indicate the total number of words that the message block contains including the command word.

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WORD

DATA

15 14 13 12 11 10 9 8 7 6 5 4 3 2 1 0

0	V	LENGTH
1	OP CODE	DATA
2	DATA	
3	DATA	
4	DATA	
5	DATA	
6	DATA	
7	DATA	
8	DATA	
9	DATA	
10	DATA	
11	DATA	
12	DATA	
13	DATA	
14	DATA	
15	DATA	

FIGURE 2. MESSAGE BLOCK FORMAT

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3.1.4.2.2 Op Code. The most significant byte of the second word shall be used to contain an OP CODE. This OP CODE shall identify the message type.

3.1.4.2.3 Low Priority Transfer Procedure. The two message buffers using polling transfer procedures shall have the first word in each buffer designated as a status location. This status word shall be used to control the entry and retrieval of messages from the buffer area. The source unit shall access and test the status word to determine when the buffer is empty and ready to accept the next message. The source unit shall wait until the buffer is empty, then enter the message into the buffer area. The last operation shall consist of modifying the status word to indicate that the buffer contains a message ready for transfer. The destination device will periodically test the status word to determine when a message is present. When a message is indicated, the destination device will read the message and its last operation shall consist of modifying the status word indicating that the buffer is available for the next message.

3.1.4.2.4 High Priority Transfer Procedure. The high priority message buffers shall employ an interrupt to initiate urgent message transfers between the Sorter and the System Controller. The status word shall be used to control the entry and retrieval of messages from the buffer area. The sending device (Sorter or System Controller) shall access the status word and test the valid bit to determine if the buffer is empty and ready to accept the next message. The sending device shall wait until the valid bit is zero then enter the message into the buffer area. The next operation shall consist of changing the status word to set the valid bit and indicate the message length. The last operation shall consist of writing to an interrupt generator to interrupt the destination device. The interrupt generators are located as follows:

Interrupt	Address
SC to Sorter	C010 (Hex)
Sorter to SC	C011 (Hex)

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The receiving device shall respond to such interrupts by reading the message block starting with the status word. Reading of the interrupt generator by the receiving device resets the interrupt but the sending device shall not enter a new message until the valid bit has been reset. The receiving device shall reset the valid bit as the last operation in the interrupt message transfer sequence.

3.1.4.3 Special Controls. The System Controller shall exercise certain special control functions over the Sorter by using dual store instruction sequences. A block of sixteen contiguous addresses shall be dedicated for use with these store instruction pairs. Five sequences of two store instructions each shall correspond to five special control functions. Each control function is effected by executing a store instruction pair from the System Controller to the effective address. Any stored data is irrelevant and ignored. Any addressing mode may be used which invokes one of the sixteen dedicated addresses. The functions and associated store instruction addresses are given in Table I.

3.1.4.3.1 Special Control Utilization. Utilization of the five functions is as follows:

- | | |
|---|--|
| 1. STOP | Halts the Sorter Supervisor after the next instruction fetch. |
| 2. INITIALIZE | Resets the Sorter Supervisor internal control register. Includes the STOP function. |
| 3. START after STOP | Initiates a continuous RUN beginning with the last fetched but unexecuted instruction. |
| 4. START after
INITIALIZE | Initiates a continuous RUN beginning with the instruction at the current value of the Program Counter. |
| 5. START and NEWSTART
(after INITIALIZE) | Initiates a continuous RUN from the address contained in memory location 0. |
| 6. Single INR | Executes one instruction and halts the Sorter Supervisor after the next instruction fetch. |

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TABLE I. Special Control Functions

Special Control Function	First Store Instruction Effective Address (HEX)	Second Store Instruction Effective Address (HEX)
Stop	FF8A	FF8B
Initialize	FF8F	FF8B
Start	FF89	FF8B
Newstart	FF81	FF8B
Single INR	FF88	FF8A

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3.2 PERFORMANCE

3.2.1 CP Bus Timing

3.2.1.1 Write Operations. Write operations shall consist of one word transfers using the timing diagram shown in Figure 3.

3.2.1.2 Read Operations. Read operations shall consist of one word transfers using the timing diagram shown in Figure 4.

3.2.2 Low Priority Retrieval Latency

The destination device (Sorter or System Controller) of a message transferred using the polling technique shall accept the message and clear the buffer area on the average of one millisecond after the status word has been set to indicate the presence of a message.

3.3 DATA REQUIREMENTS

3.3.1 System Controller Inputs

The Sorter shall be capable of transferring the messages listed in Table II to the System Controller. The detailed message formats shall be as given in the following descriptions.

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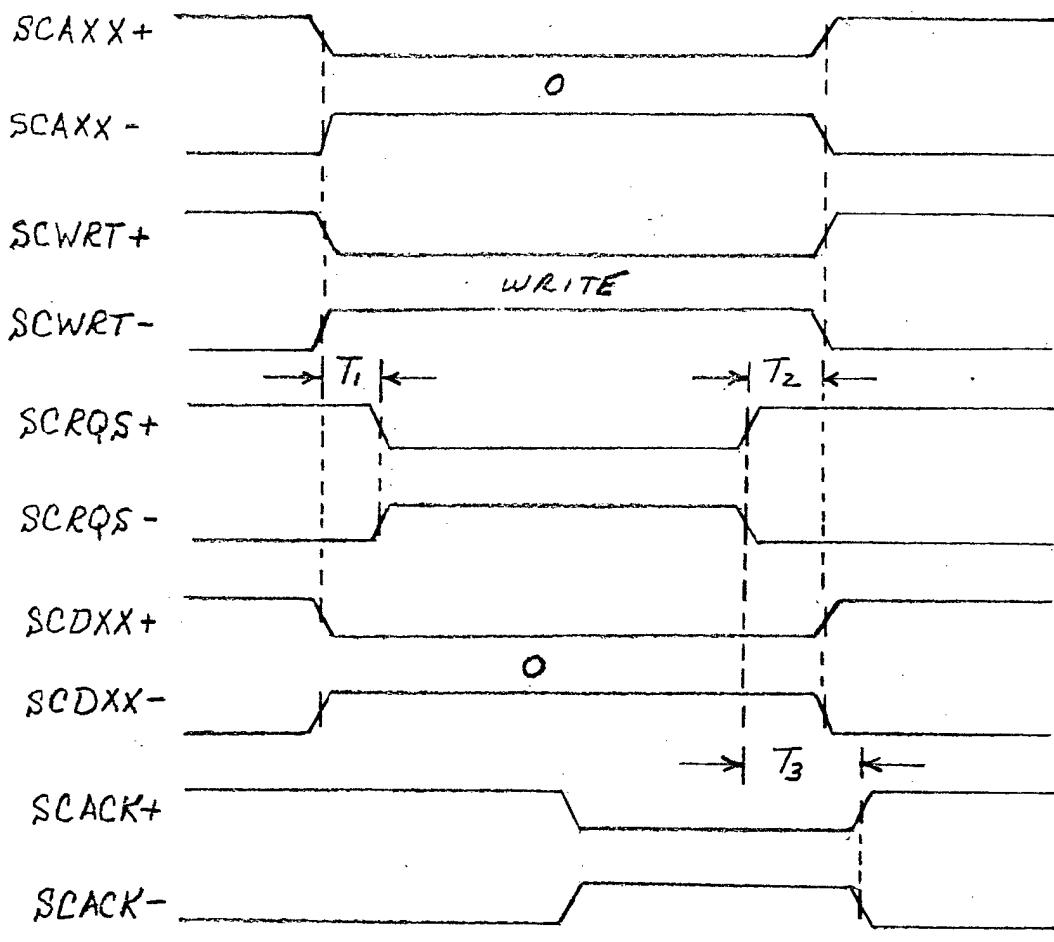
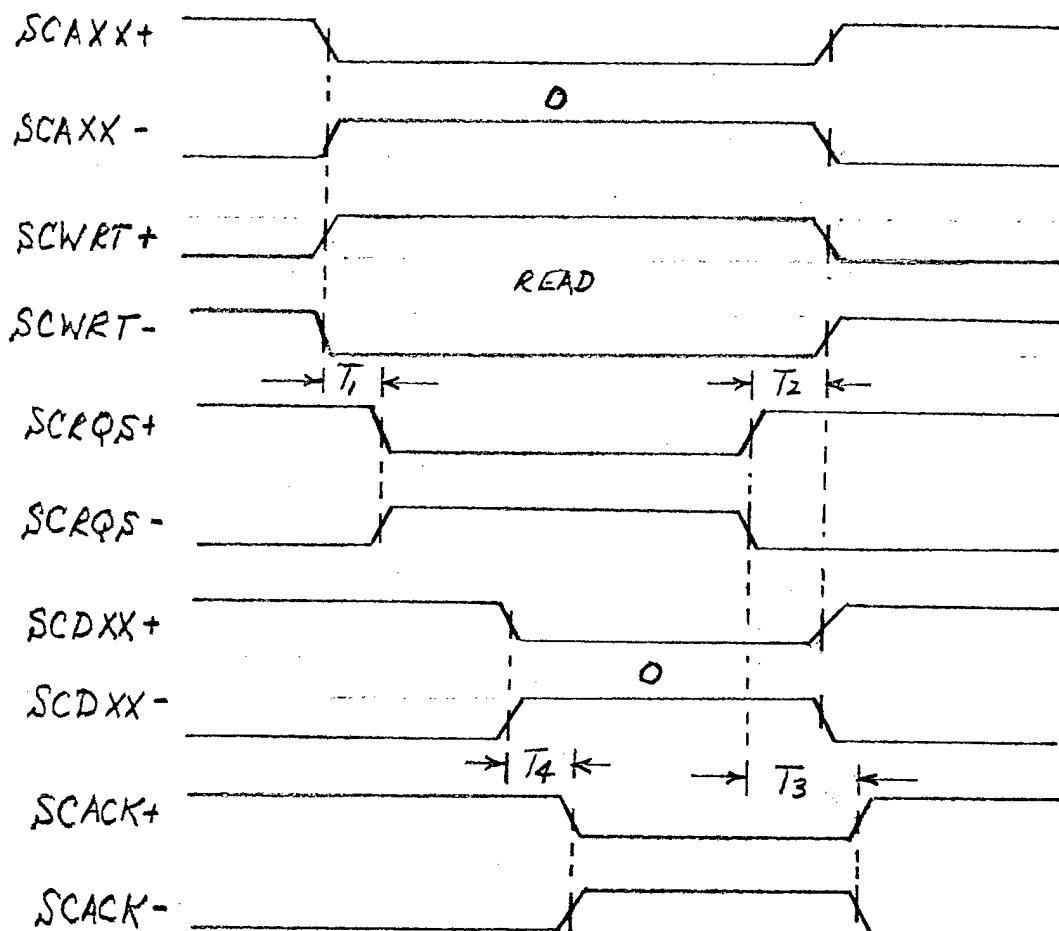


FIGURE 3. Bus TIMING, WRITE OPERATION

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$T_1 \geq 25, T_2 \geq 25, 75 \geq T_3 \geq 50, T_4 \geq 25$
 (ALL TIMES IN NANoseconds)

FIGURE 4. Bus TIMING, READ OPERATION

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TABLE II. SORTER TO SC MESSAGES

PRIORITY	OP CODE	NAME	FUNCTION	PRIORITY	OP CODE	NAME	FUNCTION
L	80	PTDW	CONTENTS OF TRACK FILE	L	8F	ALR-50	ALR-50 BITS DETECTED DURING A SUPERVISOR UPDATE OF FILE
H	81	NEW Emitter ALERT	ADVISES SC OF THE DETECTION OF A NEW Emitter	L	90	NPDW MESSAGE	LIST OF PDWS USED TO START A NEW Emitter FILE
L	82	CAM FILE DUMP	INST DUMP OF NESU CAM FILES	L	91	MEMORY DUMP	TRANSFERS 8 WORDS OF MEMORY FROM THE SORTER SUPERVISOR TO THE SC
L	83	ADA READOUT	COPY NESU ADA FILE TO SC	L	92	MULTIFREQ FLAGS	MULTIFREQUENCY FLAGS DETECTED IN PDWS DURING SUPERVISOR UPDATE
H	84	THROTTLE ALERT	ALERTS THE SC THAT A THROTTLE FILE HAS BEEN ESTABLISHED	L	93	BIT STATUS	INITIATE OFF LINE BIT OPERATION
L	85	CONFIRM FILE CREATION	SUPPLIES FILE NUMBER FOR SC CREATED FILE				
H	86	ERROR ALERT	AN ERROR HAS BEEN DETECTED BY THE SUPERVISOR	L			
L	87	INACTIVE FILE ALERT	FILE IS NOT RECEIVING UPDATE PDWS				
L	88	LONG PULSE PARAMETERS	DATA ON SAMPLED LONG PULSES	L			
L	89	1B<1/4 FULL	INPUT BUFFER IS LESS THAN 1/4 FULL	L			
L	8A	1B>3/4 FULL	INPUT BUFFER GREATER THAN 3/4 FULL	L			
L	8B	FILES FULL	NEW Emitter DETECTED BUT ALL FILES ARE FULL	H			
L	8C	THROTTLE FILES FULL	ALL 8 PD THROTTLE FILES ARE IN USE	H			
H	8D	BUS HUNG	SUPERVISOR BUS NOT RESPONDING	H			
H	8E	WATCHDOG TIMER RESET	WATCHDOG TIMER NOT RESET				



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BIT POSITION

115	OP CODE 80	SFN
4 MSB	L TDA 121110 N P S P	TAZ 0

LTD A (LS 16 BITS)	1514	S	C H R	O	PRIA
--------------------	------	---	-------	---	------

PR1B	TCODE	TTAMP	TPW
00	15	8 7 4	0

TOPRI	TOPM	TGF	TDAZ
5	12	7	4

TRACK FREQUENCY

TCOUNT	TRACK FREQUENCY
1	~4.5

MESSAGE NAME- PULSE
OPERATION CODE- 80

FUNCTION TRANSMIT

LTD A (LS 16 BITS)

1514
SCH 0
PRIA

PR1B	TCODE	TTAMP	TPW
00	15	8 7 4	0

5	12	7	4	0
TOPRI	TOPM	TGF	TDAZ	

TRACK FREQUENCY

TCOUNT	TRACK FREQUENCY
1	~4.5

MESSAGE NAME - PULSE TRAIN DESCRIPTOR WORD (PTDW)
OPERATION CODE - 80

FUNCTION TRANSMITS THE CONTENTS OF THE SPECIFIED TRACK FILE TO THE SYSTEM CONTROLLER

FIELD	FUNCTION	UNITS	SCALE
SFN	SORTER FILE NUMBER	CELL	LSB=1
TAZ	TRACK AZIMUTH		
SCHR	TRACK HISTORY REQUEST		
LTOA	FROM SC		
NS	TRACKER IN NEW SCAN MODE		
PP	PRI POINTER 0=A, 1=B		
	MS 4 BITS OF LAST TIME	MICROSEC	2 ¹⁷
	OF ARRIVAL		

LTOA	LS 16 BITS OF LTOA EST OF PRI SMALLEST IF DUAL MODE	MICROSEC 1	1.25
PRIA	EST OF PRI LARGEST IF DUAL MODE	MICROSEC 1	
PRIB	TRACK FREQUENCY	MHZ	
TF	TEST TRACK FILE FOR BITE		
TT	IF SET, FILE IS OF CW Emitter		
TCA	IF SET, Emitter Freq Agile		
TA	SET IF FILE CONTAINS VALID		
TV	DATA		



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BIT POSITION

15	0	OP CODE 81	SFN
15	121110	N P 4 MSB S P	TAZ

LTOA (LS 16 BITS)

15	4	TCODE	TTAMP	TPW
15	12	TQPRI	TQF	TQAZ

15	4	TCOUNT	TPAMP	T T C T V A W T
15	3	TRACK FREQUENCY	TCW TA TV	TEST TRACK FILE FOR BITE IF SET, FILE IS OF CW Emitter IF SET, Emitter Freq Agile SET IF FILE CONTAINS VALID DATA

MESSAGE NAME - NEW Emitter ALERT
OPERATION CODE - 81

FUNCTION ADVISES SYSTEM CONTROLLER THAT
A NEW Emitter HAS BEEN
DETECTED AND GIVES
EMITTER PARAMETERS

FIELD	FUNCTION	UNITS	SCALE
SFN	SORTER FILE NUMBER	CELL	LSB=1
TAZ	TRACK AZIMUTH		
SCHR	TRACK HISTORY REQUEST FROM SC		
NS	TRACKER IN NEW SCAN MODE		
PP	PRI POINTER 0=A, 1=B		
LTOA	MS 4 BITS OF LAST TIME MICROSEC OF ARRIVAL	2 ¹⁷	
LTOA	LS 16 BITS OF LTOA EST OF PRI SMALLEST IF DUAL MODE	MICROSEC	1
PRIA	EST OF PRI LARGEST IF DUAL MODE	MICROSEC	1
PRIB	TEST TRACK FREQUENCY MHZ		1.25
TF	TEST TRACK FILE FOR BITE IF SET, FILE IS OF CW Emitter IF SET, Emitter Freq Agile SET IF FILE CONTAINS VALID DATA		
TCW			
TA			
TV			

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BIT POSITION

MESSAGE NAME- NEW Emitter ALERT (CONT)
OPERATION CODE- 81

15	8	7	0					
OP CODE	81			SFN				
15	12	11	10	7				
L TDA	N P			TAZ				
4 MSB	S P							
15								
LTOA (LS 16 BITS)								
15	14	0	0	PRIA				
SC	H	O	R					
00				PRIB				
15	8	7	4	0				
TCODE	TTAMP		TPW					
15	12	7	4	0				
TQRI	TQW	TQF	TQAZ					
15								
TRACK FREQUENCY								
13	9	4	3	2	1	0		
TCOUNT	TPAMP	V	T	T	C	T		
		A				W		

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BIT POSITION

15	8	0
OP CODE	82	CFN
11	11	11
10		

12	8	5
FREQUENCY		
11	11	11
10		

12	8	5
AZIMUTH	X	COUNT
11	11	11
10	V	

12	8	5
11	11	11
10		

12	8	5
11	11	11
10		

12	8	5
11	11	11
10		

12	8	5
11	11	11
10		

12	8	5
11	11	11
10		

12	8	5
11	11	11
10		

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BIT POSITION

15	8	0
OP CODE	83	AOACEL

ADACNT

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MESSAGE NAME- AOA READOUT
OP CODE- 83FUNCTION- PROVIDES THE SYSTEM CONTROLLER
WITH A COPY OF THE NESU
MULTIPLE MESSAGES REQUIRED
TO SEND COMPLETE FILE

FIELD	FUNCTION	UNITS	SCALE
AOACEL	CELL NUMBER FOR INDICATED AOA COUNT	CELL	LSB=1
AOACNT	NUMBER OF PDWS ACCUMULATED IN CELL	COUNTS	LSB=1

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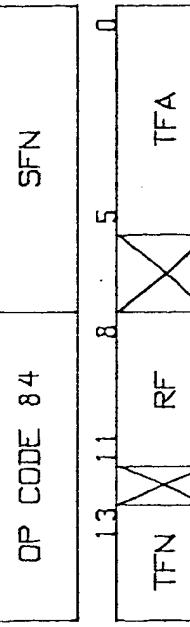
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BIT POSITION

15 8 0

MESSAGE NAME - THROTTLE ALERT
OP CODE - 84

FIELD

FUNCTION

UNITS

SCALE

SFN

FILE NUMBER

RF

REDUCTION FACTOR

CELLS

LSB=1/16

TFA

THROTTLE FILE AZIMUTH

1

MHz

THROTTLE FILE FREQ

10 MHz

TFN

THROTTLE FILE NUMBER

FUNCTION - ADVISES THE SYSTEM CONTROLLER
THAT THE SORTER HAS
ESTABLISHED A THROTTLE FILE AND PROVIDES
THE ASSOCIATED TRACK FILE NUMBER
AND RELATED PARAMETERS

BIT POSITION

15	
8	
OP CODE 85	SFN

MESSAGE NAME - CONFIRM FILE CREATION

OP CODE - 85

FUNCTION - ADVISES SYSTEM CONTROLLER OF THE FILE
NUMBER ASSIGNED TO AN SC CREATED FILE

FIELD

SFN

FUNCTION

FILE NUMBER

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BIT POSITION MESSAGE NAME - ERROR ALERT

OP CODE - 86

OP CODE	ERROR CODE
8	0

FUNCTION - ADVISE THE SYSTEM CONTROLLER
THAT ONE OF THE FOLLOWING
MESSAGES HAVE OCCURRED

ERROR CODE	FUNCTION
01	INVALID HI-PRIORITY MESSAGE RECEIVED FROM SC
02	SORTER PURGED NEW Emitter PDWS BEFORE REQUEST WAS RECEIVED
03	NOT USED
04	INVALID MESSAGE RECEIVED FROM NESU
05	INVALID LO-PRIORITY MESSAGE RECEIVED FROM SC
06	WATCHDOG TIMER EXPIRED, BUT SUPERVISOR SOFTWARE INTACT
07	"DO NOT UPDATE" BIT SET IN Emitter TABLE FOR NEW Emitter OR HI DATA RATE THREAT EMITTER
81	AGILE: AOA COUNT ≥ THRESHOLD BUT AZIMUTH SEARCH FINDS NO MATCH
82	AGILE: AOA COUNT ≥ THRESHOLD BUT AZIMUTH SEARCH FINDS ONLY 1 MATCH
83	ILLEGAL SUP. MESSAGE RECEIVED BY NESU
84	NESU RECEIVED HUNG BUS INTERRUPT

BIT POSITION

15	8	0
OP CODE 87	SFN	

MESSAGE NAME - INACTIVE SORTER FILE
OP CODE - 87

FUNCTION - SPECIFIED FILE HAS NOT BEEN RECEIVING
PDWS FOR THE PERIOD OF THE PURGE
INTERVAL

FIELD FUNCTION
SFN FILE NUMBER

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15 8 0

OP CODE 88 SFN

13

PRIA

13

PRIB

3 PW COUNT

0

MESSAGE NAME - 1/4 FULL

OP CODE - 89

FUNCTION - INPUT BUFFER < 1/4 FULL

15 8 0

OP CODE 8A

0

MESSAGE NAME - 3/4 FULL

OP CODE - 8A

FUNCTION - INPUT BUFFER > 3/4 FULL

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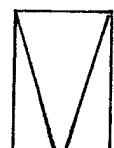
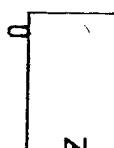
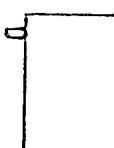
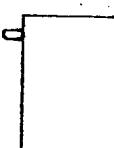
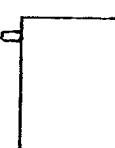
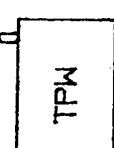
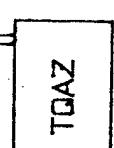
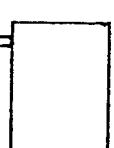
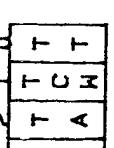
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BIT POSITION	MESSAGE NAME- NEA/TRACK FILE FULL OPERATION CODE- 8B	FUNCTION	ADVISES SYSTEM CONTROLLER THAT A NEW Emitter HAS BEEN DETECTED. PROVIDES Emitter PARAMETERS, AND WARNS THAT ALL FILES ARE FULL EMITTER IS NOT TRACKED	UNITS	SCALE
15 8 7 0		LTDA 4 MSB	LTDA (LS 16 BITS)	TAZ SCHR	CELL LSB=1
15 12 11 10 2 0 0 0		LTDA 4 MSB		PRIA	TRACK AZIMUTH TRACK HISTORY REQUEST FROM SC
15 0 0 0 0 0 0 0		PRIB		LTDA PP	TRACKER IN NEW SCAN MODE PRI POINTER 0=A, 1=B MS 4 BITS OF LAST TIME MICROSEC OF ARRIVAL
15 8 7 4 0 0 0 0		TCODE		LTDA PRIA	LS 16 BITS OF LTOA EST OF PRI SMALLEST IF DUAL MODE
15 12 7 4 0 0 0 0		TQPRI		PRIB	EST OF PRI LARGEST IF DUAL MODE
15 0 0 0 0 0 0 0		TRACK FREQUENCY		TF TT TCW TA TV	TRACK FREQUENCY MHz TEST TRACK FILE FOR BITE IF SET, FILE IS OF CW Emitter IF SET, Emitter Freq Agile SET IF FILE CONTAINS VALID DATA
13 9 4 3 2 1 0		TCOUNT		TPAMP	

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BIT POSITION

MESSAGE NAME- NEA/TRACK FILES FULL (CONT)
OPERATION CODE- 8B

BIT POSITION	0	1	2	3	4	5	6	7	8	9	10	11	12	13
OP CODE 8B	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LTOA	1	2	1	1	1	0	0	0	0	0	0	0	0	0
4 MSB	N	P	S	P	X	X	X	X	X	X	X	X	X	X
TAZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LTOA (LS 16 BITS)	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCOUNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
REQUESTED BY THE SUPERVISOR	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TPAMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PEAK DETECTED SIGNAL AMPLITUDE. RESET BY PTDW REQ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TPW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TTAMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MIN AMPL OF PDW TO BE XFERRED ON AUX BUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TQCODE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRIB	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCODE	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TTAMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TPW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TQAZ	0	0	0	0	0	0	0	0	0	0	0	0	0	0
DATA INSERTED BY SC	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AZIMUTH QUALITY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TQF	0	0	0	0	0	0	0	0	0	0	0	0	0	0
FREQUENCY QUALITY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TQPW	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PULSE WIDTH QUALITY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TQPRI	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PRI QUALITY	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TCOUNT	0	0	0	0	0	0	0	0	0	0	0	0	0	0
TPAMP	0	0	0	0	0	0	0	0	0	0	0	0	0	0
V A W	0	0	0	0	0	0	0	0	0	0	0	0	0	0

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CODE IDENT NO.

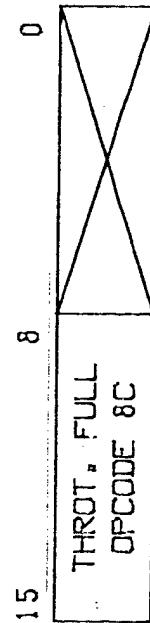
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BIT POSITION

MESSAGE NAME-AS NOTED
OP CODE- AS NOTED

NOTE SFN =FILE NUMBER

MESSAGE

MESSAGE	FUNCTION
THR FILES FULL	ALL 8 THROTTLE FILES ARE FULL
BUS HUNG	SUPERVISOR BUS NOT RESPONDING
WATCHDOG	WATCHDOG TIMER NOT RESET WITHIN SPECIFIED TIME INTERVAL
ALR-50	ALR-50 BITS ARE SET AT UPDATE TIME

OP CODE 8D

OP CODE BE

SFN

OP CODE 8F

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SPEC NO.

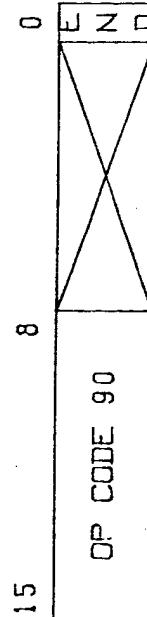
53959-JK-1002

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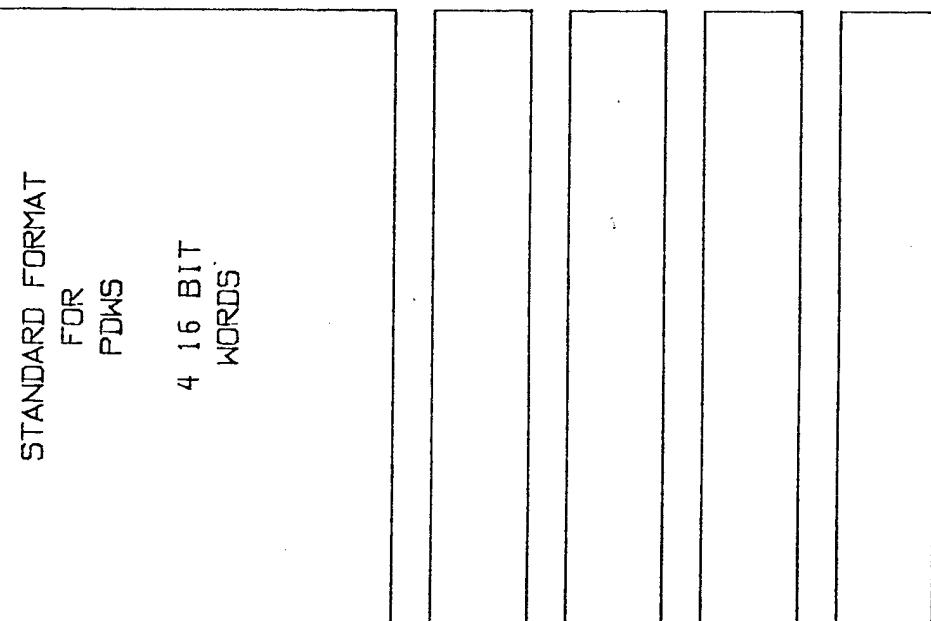
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REV 3

BIT POSITION

MESSAGE NAME- NPDW MESSAGE
OP CODE- 90FUNCTION- LIST OF PDWS USED TO START
TRACK FILE

FIELD	FUNCTION
END	WHEN SET, INDICATES LAST NPDW MESSAGE FROM PRESENT REQUEST

STANDARD FORMAT
FOR
PDWS4 16 BIT
WORDS

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BIT POSITION

MESSAGE NAME - MEMORY DUMP

OP CODE - 91

FUNCTION IN RESPONSE TO SYSTEM CONTROLLER
REQ. TRANSFERS 8 WORDS
OF SORTER MEMORY TO
THE CONTROLLER

15 0

MEMORY DUMP
OP CODE 91

8 WORDS OF
SORTER MEMORY
IN SEQUENCE



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MESSAGE NAME- MULTIFREQUENCY FLAGS

OPERATION CODE- 92

FUNCTION- ADVISES SC THAT THE
SOFTWARE UPDATE HAS DETECTED
N MULTIFREQ FLAGS SET IN
THE UPDATE SET OF PDWS

FIELD SFN
FUNCTION
SORTER FILE NUMBER

0

OP CODE	92	SFN
1	1	1

15

1

1

1

1

1

1

1

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BIT POSITION

15 0

OP CODE	93

EFN	

TN	

TTP	

ADTA	

EDTA	

INDX	

LCOM	

CNTRL	

INTR	

MESSAGE NAME - BIT STATUS MESSAGE

OP CODE - 93

FUNCTION - REPORT BIT STATUS IN
RESPONSE TO A REQUEST FROM THE
SYSTEM CONTROLLER

FIELD

PF1

PASS/FAIL INDICATOR
BIT ERROR CODE
(SEE SPEC.)

EFN

FILE NUMBER IN ERROR

TN

TEST NUMBER
TEST TABLE POINTER

ADTA

ACTUAL DATA
EXPECTED DATA

INDX

INDEX (IF APPLICABLE)
LAST COMMAND ISSUED TO UNIT

CNTRL

CONTROL STATUS WORD
INTERRUPT STATUS WORD

3.3.2 System Controller Outputs

The System Controller shall be capable of transferring the messages listed in Table III to the Sorter. The detailed message formats shall be as given in the following descriptions.

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TABLE III. SC TO SORTER MESSAGES

PRIORITY	OP CODE	NAME	FUNCTION	PRIORITY	OP CODE	NAME	FUNCTION
H	01	SORTER START	SORTER GOES FROM IDLE TO RUN MODE	L	0F	STOP SPDWS	STOP TRANSFER OF SPDWS FOR THE SPEC FILE NUMBER
H	02	PAUSE	GO TO IDLE MODE	L	10	NEPDW REQ	TRANSFER ALL PDWS USED TO START A FILE TO THE SC
H	03	INITIALIZE	INITIALIZE ALL SORTER PARAMETERS	L	11	DELETE FILE	COMMAND SORTER TO DROP A TRACK FILE
H	04	INIT/START NESU	CLEAR NESU BUFFER FILES AND START SEARCH TX NESU CAM FILE DATA TO SC	L	12	FREQ MOD	CHANGE TRACK FREQUENCY
L	05	CAM FILE DUMP	REQUESTS THAT NESU AOA FILE BE TX TO SC	L	13	PRI MOD	* * PRIS
L	06	AOA READOUT REQUEST	DUMP ALL TRACK FILES TO THE SC	L	14	THROTTLE FILE MOD	MODIFY EXISTING THROTTLE FILE DATA
L	07	FILE DUMP	SEND ALL UPDWS TO THE SC VIA THE AUX BUS	L	15	AOA THRESHOLD MOD.	CHANGE NUMBER OF PDWS REQUIRED TO TRIGGER AN AGILE Emitter SEARCH
L	08	UPDW REQUEST	INJECT SYNTHETIC PDW INTO THE INPUT BUFFER	L	16	CREATE FILE	ALLOWS THE SC TO GENERATE A SYNTHETIC FILE
L	09	SYNTHETIC PDW	CHANGE NUMBER OF PDWS REQUIRED TO START A NEW Emitter	L	17	STOP UPDW	STOP TRANSFER OF UPDWS ON THE AUX BUS
L	0A	NESU THRESHOLD	CHANGE THE QUALITY BITS ON ALL PARAMETERS	L	18	PW MOD	CHANGE TRACK PW
L	0B	QUAL BIT MODIF.	CHANGE PURGE • UPDATE TIME • AND PRIORITY	L	19	TRANSFER TABLE	REQUESTS SORTER SUPERVISOR TO SEND MEMORY CONTENTS TO SC.
L	0C	TRACK PRIORITY MODIFY	REQUEST PTDW ON SPECIFIED FILE	L	1A	MODIFY ADDRESS	ALLOWS SC TO CHANGE SORTER MEMORY CONTENTS
L	0D	PTDW REQ.	REQUEST TRANSFER OF SPDWS ON THE AUX BUS	H	1B	PAUSE NESU	PUT THE NESU IN IDLE MODE
L	0E	SPDWS REQ		L	1C	BIT REQ	REQUESTS EXEC OF BIT TESTING OFF-LINE

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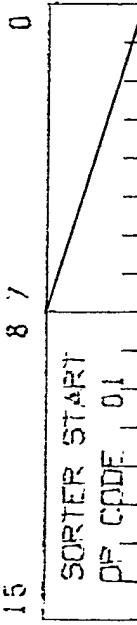
53959-JK-1002

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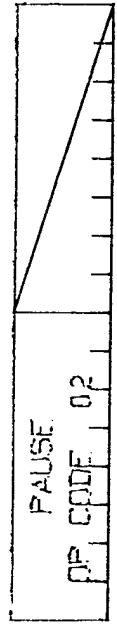
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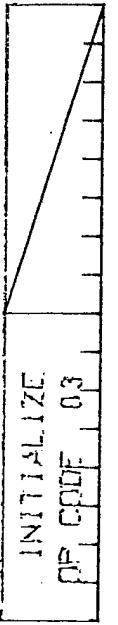
BIT POSITION 15 8 7 0



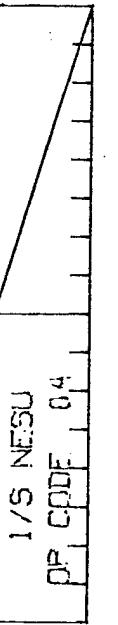
DP CODE 01



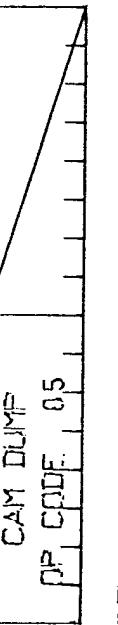
DP CODE 02



DP CODE 03



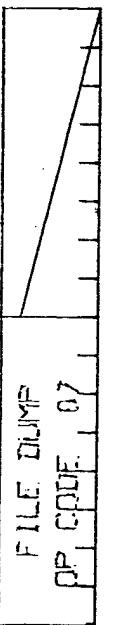
DP CODE 04



DP CODE 05



DP CODE 06



DP CODE 07

MESSAGE NAME - COMMAND MESSAGES

DP CODES - AS NOTED

COMMAND

START PAUSE
TRANSFER SORTER FROM PAUSE
TO SORT MODE

PAUSE
PLACES SORTER IN AN IDLE
LOOP, SORTER RESP. ONLY TO SC
LOW PRIORITY MESSAGES

INITIALIZE

SET INIT PARAMS
ENTER IDLE LOOP

INIT/START
NESU

CLEAR CAM FILES, START SEARCH FOR
NEW EMITTERS

CAM FILE
DUMP

DUMP NESU CAM FILES TO SC

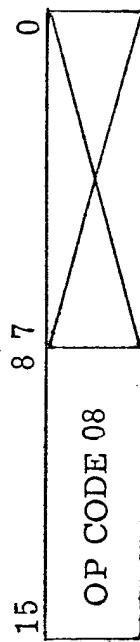
AOA READOUT
REQUEST

DUMP AOA FIRE AGILE TRAP
TO THE SC

FILE DUMP
REQUEST

DUMP ALL TRACK FILES TO SC

BIT POSITION



MESSAGE NAME - UPDW REQ
OP CODE - 08

FUNCTION - REQ ALL UNASSOCIATED PDWS BE SENT TO
TO THE SC VIA THE AUX BUS

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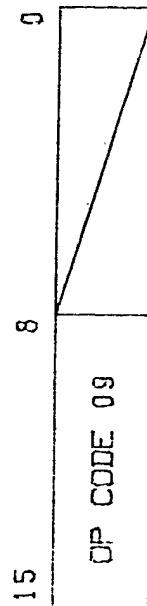
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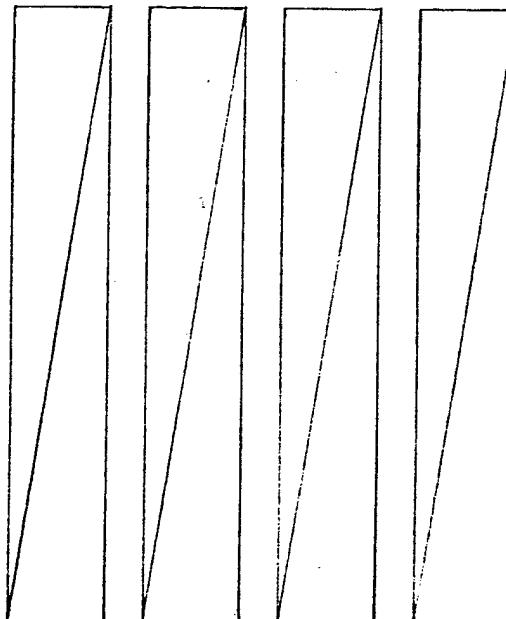
OP CODE 09

MESSAGE NAME - SYNTHETIC PDW

OP CODE - 09

FUNCTION - INJECTS SYNTHETIC PDWS
AS SPECIFIED BY STD. PDW
INTO THE INPUT BUFFER

STANDARD PDW TEXT





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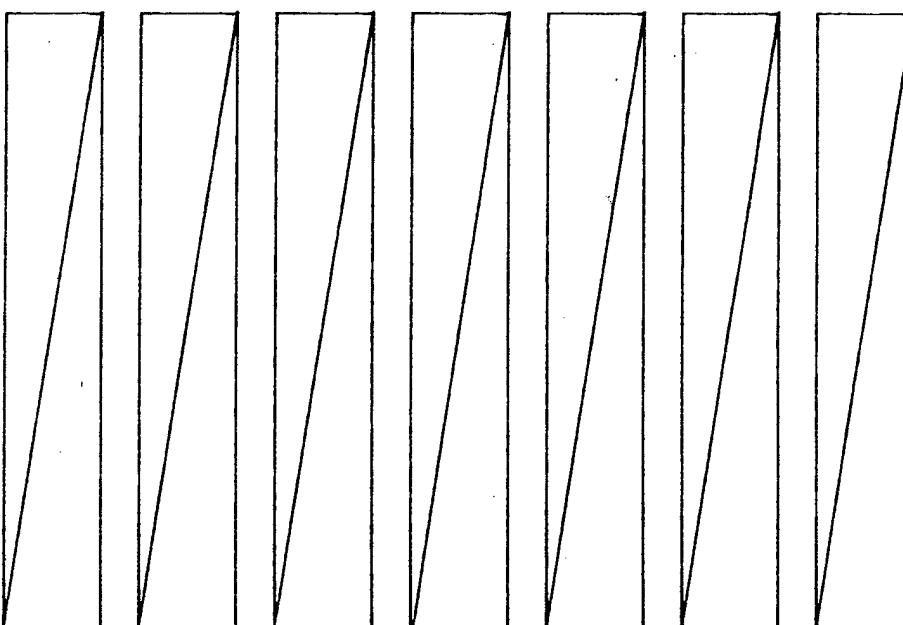
REV 3

BIT POSITION

MESSAGE NAME - QUALITY BIT MODIFICATION
OP CODE - 0BFUNCTION - CHANGE THE PARAMETER QUALITY
BITS FOR A GIVEN
TRACK. ALL QUAL
BITS ARE CHANGED TO
THOSE INDICATED

15	8	7	0	0
OP CODE	0B	SFN		
TQPRI	TQPW	TQF	TQAZ	

FIELD	FUNCTION	UNITS	SCALE
SFN	FILE NUMBER		LSB=1/2
TQAZ	AZIMUTH WEIGHT		LSB=1/2
TQF	FREQ WEIGHT		LSB=1/2
TQPW	PW WEIGHT		LSB=1/2
TQPRI	PRI WEIGHT		LSB=1/2



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BIT POSITION MESSAGE NAME - TRACK PRIORITY MODIFY

OP CODE - 0C

0	OP CODE 0C	SFN
15	1 J P 1	PURGE

FIELD	FUNCTION	UNITS	SCALE
SFN	FILE NUMBER (DON'T CARE) INDICATES TOP PRIORITY 1 SEC UPDATE		
P	IF=1, UPDATE EVERY 2 SEC IF=0, UPDATE EVERY 4 SEC		
I*	IF=1, FILE HAS PASSED PURGE TIME WITHOUT ANY NEW PDWS		
PURGE	MAX TIME INTERVAL DURING WHICH NEW DATA MUST BE RECEIVED OR INACTIVE FILE MSG IS TRANSMITTED AFFECTS ALL TRACK FILES	SECONDS	50 MSEC

* NOT LOOKED AT BY SORTER

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BIT POSITION MESSAGE NAME - PTDW REQUEST

OP-CODE - 0D

FUNCTION - REQUEST BY THE SC THAT
THE SPECIFIED TRACK
FILE BE TRANSMITTED TO
THE SC.

0

OP CODE 0D	SFN
------------	-----

FIELD	FUNCTION	UNITS	SCALE
SFN	TRACK FILE NUMBER		

15

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BIT POSITION

MESSAGE NAME -SPDW REQUEST

OP CODE - 0E

FUNCTION - REQUESTS SORTER TO TRANSFER
SPDW'S OF IND. FILE
ON THE AUX BUS

0	15	OP CODE 0E	SFN	FIELD	FUNCTION	UNITS	SCALE
		TTAMP	TCODE	SFN	FILE NUMBER		
				TTAMP	DEFINES AMPL. LEVEL ABOVE WHICH PDWS WILL BE XFERRED ON THE AUX BUS	DBM	3.2



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BIT POSITION MESSAGE NAME - SPDW STOP

OP CODE - 0F

FUNCTION - STOP XFER OF SPDWS
FROM THE SPECIFIED FILE

0

SFN

OP CODE OF

FIELD FUNCTION

SFN FILE NUMBER

SCALE

UNITS

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BIT POSITION MESSAGE NAME - NEPDW REQUEST

OP CODE - 10

FUNCTION - REQ THAT PDWS USED TO
START SPEC. FILE
BE XFERRED TO THE
SC. (INSTRUMENTATION)

0

OP CODE 10 | SFN

FIELD FUNCTION
SFN FILE NUMBER

SCALE

UNITS

FIELD

SFN

15

--	--	--	--	--	--	--	--	--	--

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MESSAGE NAME - DELETE TRACK FILE

OP CODE - 11

FUNCTION - COMMANDS SORTER TO DELETE
THE SPEC TRACK FILE

BIT POSITION

0

OPCODE 11	SFN
-----------	-----

SCALE

UNITS

FUNCTION

FIELD

FILE NUMBER

SFN

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MESSAGE NAME - FREQUENCY MODIFICATION
OF CODE - 12FUNCTION - CHANGE SORTER ESTIMATE
OF THE Emitter FREQUENCY

BIT POSITION	FIELD	FUNCTION	UNITS	SCALE
15	SFN	FILE NUMBER	MHZ	1.25
8	MODF	VALUE TO REPLACE SORTER FREQ EST		
7				
0				

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BIT POSITION MESSAGE NAME - PRI MODIFICATION

OP CODE - 13

FUNCTION - CHANGES THE VALUES OF PRIA
AND PRIB IN THE
SPECIFIED TRACK FILE

0

FIELD	FUNCTION	UNITS	SCALE
SFN	FILE NUMBER		1 MICROSEG.
MODPRIA	NEW PRI VALUE	SECONDS	1 MICROSEG.
MODPRIB	NEW PRI VALUE	SECONDS	1 MICROSEG.

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MESSAGE NAME - THROTTLE FILE MODIFICATION

OP CODE - 14

FUNCTION - REPLACE EXISTING THROTTLE FILE DATA
WITH THAT IN MESSAGE

BIT POSITION	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
OPCODE	14		SFN													
TFN			RF		TFA											
				TFF												

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MESSAGE NAME - AOA THRESHOLD MODIFICATION

OP CODE - 15

FUNCTION - CHANGE NUMBER OF PDWS REQUIRED
TO START AN AGILE FILE

BIT POSITION

15 8 7 0

OPCODE 15	AZCNT

FIELD FUNCTION UNITS SCALE

AZCNT NUMBER OF PDWS
REQUIRED TO START
NEW Emitter ANALYSIS
PROCESS

--	--	--	--	--	--	--	--	--

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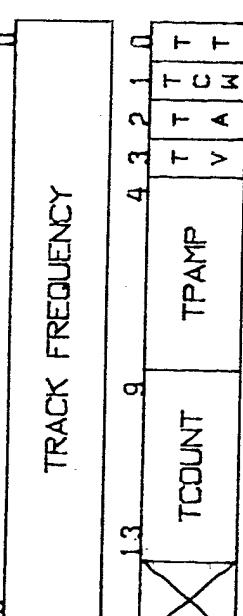
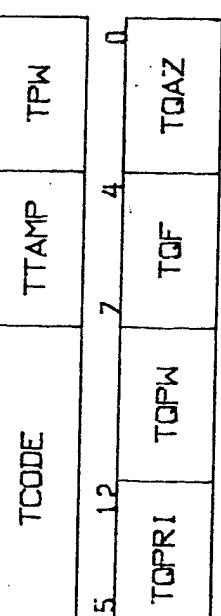
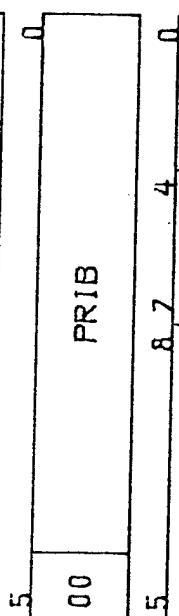
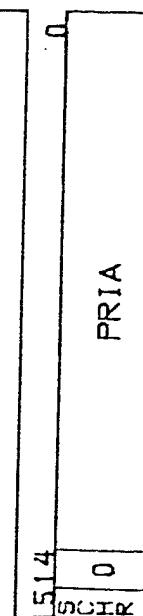
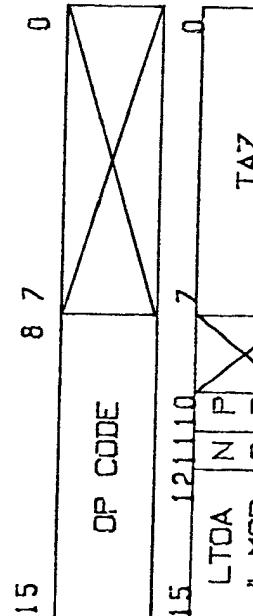
REV

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BIT POSITION

MESSAGE NAME- CREATE TRACK FILE
OPERATION CODE- 16

FUNCTION PROVIDES SORTER WITH
FORMATTED TRACK FILE
GENERATED BY SC





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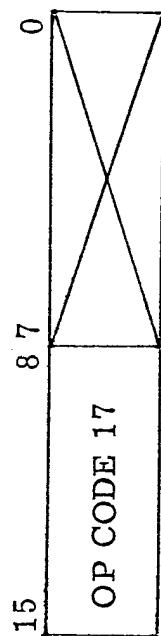
MESSAGE NAME- CREATE TRACK FILE (CONT)
OPERATION CODE- 15

OP CODE	121110	0
LTOA 4 MSB	N P S P	TAZ
LTOA (LS 16 BITS)		
PRIA		
PRIB		
TCODE	TTAMP	TPW
TQFR1	TQFW	TQAZ
TCOUNT	TPAMP	T T C V A W
TRACK FREQUENCY		

MESSAGE NAME - UPDW STOP
OP CODE - 17

FUNCTION - STOP TRANSFER OF UPDWS FROM THE
SORTER TO SC

BIT POSITION



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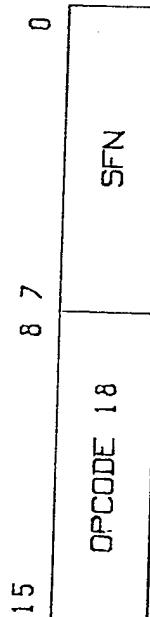
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BIT POSITION MESSAGE NAME - PULSE WIDTH MODIFICATION

OP CODE - 18

FUNCTION - REPLACE EXISTING ESTIMATE OF
PULSE WIDTH WITH VALUE SPEC.

FIELD	FUNCTION	UNITS	SCALE
SFN	FILE NUMBER		
MODPW	MODIFIED PULSE WIDTH VALUE	CELLS	1



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BIT POSITION

四

MESSAGE NAME - TRANSFER TAB E

OF CODE 18

OF CODE - 19

FUNCTION-	ALLOWS SYSTEM CONTROLLER TO EXAMINE INSTRUCTIONS AND DATA IN THE SORTER MEMORY 8 WORDS ARE TRANSFERRED IN RESPONSE
START ADDRESS	
SORTER SPECTRUM	

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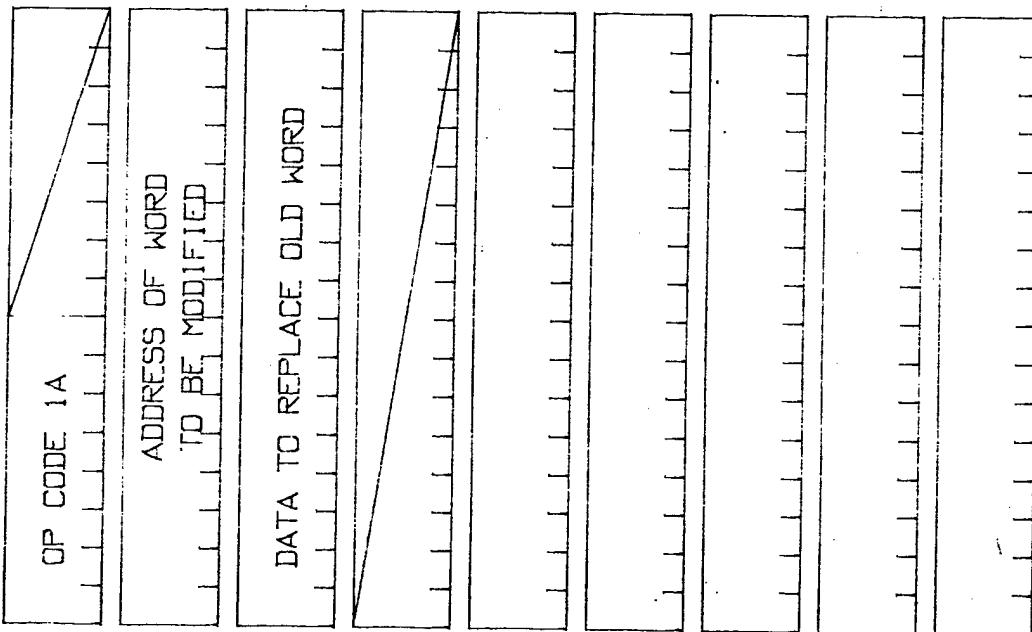
REV 3

BIT POSITION

15 0

MESSAGE NAME - MODIFY MEMORY ADDRESS

OF CODE - 1A

FUNCTION - ALLOWS THE SYSTEM MANAGER TO
CHANGE INSTRUCTIONS OR DATA
IN THE SORTER MEMORY

RAYTHEONRAYTHEON COMPANY
LEXINGTON, MASS. 02173

CODE IDENT NO.

49956

SPEC NO.

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REV 3

BIT POSITION	MESSAGE NAME - AS NOTED OPERATION CODES - AS NOTED	COMMAND FUNCTION	PAUSE NESU	PLACE NESU IN IDLE LOOP	BIT REQ	REQUEST INITIATION OF THE BIT TEST (THIS IS AN OFF LINE FUNCTION)
15	PAUSE NESU OP CODE 1B					
8						
7						
0						

3.3.3 Program Load
 (TBD)

3.4 DESIGN REQUIREMENTS

3.4.1 Line Drivers/Line Receivers

All line drivers and line receivers shall incorporate SN75110 and SN75107A type devices respectively. The CP bus shall be terminated on both ends with the termination network specified in Figure 5.

3.4.2 Interconnecting Transmission Lines

All interconnecting cables used for this interface shall utilize twisted pair. The characteristic impedance shall be $110\Omega \pm 5\%$. Twisted pair within the signal sorter shall have characteristic impedance of $107\Omega \pm 10\Omega$ with a maximum stub length of 18 inches. A termination shall be provided which has a matched pair ($\pm 1\%$) of 56 ohm resistors for each signal and its return as shown in Figure 5. The optional biasing network shall be used to bias interface lines in the absence of drivers.

3.4.3 Interface Signal Definition

Figure 6 gives the interface signals between the System Controller and the Sorter. Signals SCD00 + and SCD00 - are the signal and return respectively for the least significant data bit. SCD15 is the most significant bit. SCA00 through SCA15 are the least significant through most significant address bits respectively. The remaining signals are:

<u>Signal</u>	<u>Definition</u>
SCWRT	Write/Read
SCRQS	Request
SCACK	Acknowledge
SCSKP	Skip
SCMCL	Master Clear

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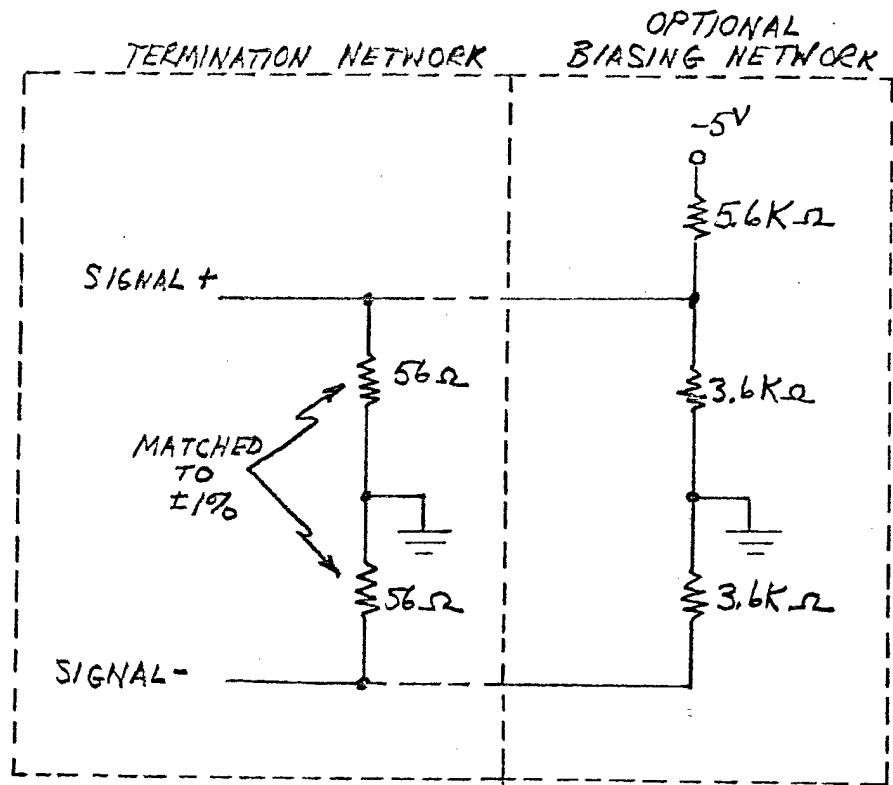


FIGURE 5. SYSTEM CONTROLLER & SPECIAL TEST EQUIPMENT TERMINATION & OPTIONAL BIASING NETWORKS

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J1 IN SYSTEM CONTROLLER

PIN #'S

1	SCD00+	1
2	SCD00-	2
13	SCD01+	13
14	SCD01 -	14
35	SCD02 +	35
36	SCD02 -	36
37	SCD03 +	37
38	SCD03 -	38
11	SCD04 +	11
12	SCD04 -	12
5	SCD05 +	5
6	SCD05 -	6
33	SCD06 +	33
34	SCD06 -	34
7	SCD07 +	7
15	SCD07 -	15
31	SCD08 +	31
32	SCD08 -	32
17	SCD09 +	17
18	SCD09 -	18
8	SCD10 +	8
16	SCD10 -	16
29	SCD11 +	29
30	SCD11 -	30
69	SCD12 +	69
70	SCD12 -	70
71	SCD13 +	71
72	SCD13 -	72
94	SCD14 +	94
95	SCD14 -	95
86	SCD15 +	86
87	SCD15 -	87

J4 & J5 IN SIGNAL SERVER

LSB

DATA

MSB

(CONTINUED ON NEXT PAGE)

FIGURE 6. INTERFACE SIGNAL LIST

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J1 IN SYSTEM CONTROLLER

PIN #'s

(CONTINUED FROM PRECEDING PAGE)

PIN #'s

J4 & J5 IN SIGNAL SORTER

67	SCA00 +	67
68	SCA00 -	68
62	SCA01 +	62
63	SCA01 -	63
81	SCA02 +	81
82	SCA02 -	82
60	SCA03 +	60
61	SCA03 -	61
75	SCA04 +	75
76	SCA04 -	76
77	SCA05 +	77
78	SCA05 -	78
48	SCA06 +	48
49	SCA06 -	49
46	SCA07 +	46
47	SCA07 -	47
92	SCA08 +	92
100	SCA08 -	100
88	SCA09 +	88
89	SCA09 -	89
79	SCA10 +	79
80	SCA10 -	80
90	SCA11 +	90
91	SCA11 -	91
23	SCA12 +	23
24	SCA12 -	24
52	SCA13 +	52
53	SCA13 -	53
45	SCA14 +	45
66	SCA14 -	66
41	SCA15 +	41
42	SCA15 -	42

(CONTINUED ON NEXT PAGE)

LSB

ADDRESS

MSB

FIGURE 6 (CONT.) INTERFACE SIGNAL LIST

SIZE A	CODE IDENT NO. 49956	DRAWING NO. 53959-JK-1002
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J1 IN SYSTEM CONTROLLER PIN (CONTINUED FROM PRECEDING PAGE) PIN J4 & J5 IN SIGNAL SORTER

58	SC WRT +	58
59	SC WRT -	59
85	SC RQS +	85
93	SC RQS -	93
83	SC ACK +	83
84	SC ACK -	84
64	SC SKP +	64
65	SC SKP -	65
43	SCPFL +	43
44	SCPFL -	44
50	SC MCL +	50
51	SC MCL -	51
39	SCRPI +	39
40	SCRPI -	40
54	PANIC +	54
55	PANIC -	55
9	SPARE	9
10	SPARE	10
19	SPARE	19
20	SPARE	20
21	SPARE	21
22	SPARE	22
27	SPARE	27
28	SPARE	28
56	SPARE	56
57	SPARE	57
73	SPARE	73
74	SPARE	74
96	SPARE	96
97	SPARE	97
98	SPARE	98
99	SPARE	99
3	SPARE	3
4	SPARE	4
(No Conn)	SC5VR (Used in sorter only)	25
(No Conn)	SC5VR (Used in Sorter only)	26

FIGURE 6 (CONTINUED)
INTERFACE SIGNAL LIST

SIZE	CODE IDENT NO	DRAWING NO.
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SCPFL

Power Fail

SCR PI

Interrupt In

Pin connections for J4 and J5 on the Signal Sorter, J1 of the System Controller and J5 on the Special Test Equipment shall be identical.

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